International Journal of Contemporary Pediatrics
Jawade PG et al. Int J Contemp Pediatr. 2016 Aug;3(3):993-1000
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20162379

Research Article

A comparative clinico-epidemiological study of acute respiratory infections and malnutrition in male and female children of central India

Pranav G. Jawade[1]*, Neelam D. Sukhsohale[2], Mohan B. Khamgaonkar[2], Gayatri G. Jawade[3], Saurabh P. Aklujkar[4], Rajkumar K. Dudhe[1], Aditya S. Bhagwat[1], Sudarshan S. Lamture[5], Nishtha P. Khatri[4], Binish ZA Khan[1]

[1]Intern, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India
[2]Department of Community Medicine, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India
[3]T. N. Medical College and BYL Nair Hospital, Mumbai, Maharashtra, India
[4]Grant Government Medical College and Sir J.J Group of Hospitals, Mumbai, Maharashtra, India
[5]Seth G.S Medical College and KEM Hospital, Mumbai, Maharashtra, India

Received: 18 May 2016
Accepted: 02 July 2016

***Correspondence:**
Dr. Pranav G. Jawade,
E-mail: dr.pranavjawade@gmail.com

ABSTRACT

Background: In developing countries like India and many, some of the most commonly seen and prevalent conditions are the Acute Respiratory Infections (ARI) and Malnutrition in the pediatric age group. It is indeed a necessity of the time to understand the clinic-epidemiological aspects of it and develop an insight, which can help us to assess the ill effects on the child health and strengthen our policy.
Methods: A hospital based cross sectional study was carried out in children aged 0-14 years. Children were clinically assessed and diagnosis was made as URTI or LRTI Also anthropometry was performed and accordingly children were divided into categories of No Malnutrition (NM), Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) in 'under 5' years age children according to WHO guidelines, whereas children aged 'above 5' years were categorized as per the IAP guidelines.
Results: On comparing the various socio-demographic aspects and environmental factors the incidence of Acute Respiratory Infections was found to be more or less equal in both male and female study subjects. The Anthropometric parameters were also similar and the difference was statistically insignificant. In Under 5 Age group study subjects incidence of SAM was 42.5% in male children as compared to 33.33% female children. In Above 5 age group study subjects 50% female study subjects were normal as compared to 42.10% male children. The incidence of overcrowding was 54.23% in male study subjects as compared to 70.73% female study subjects and the difference was found to be statistically significant as (P=0.04).
Conclusions: When comparing male and female study subjects the incidence and association of various socio-demographic and environmental factors is more or less similar without any statistically significant difference. However incidence of SAM is slightly higher in males whereas incidence of MAM is slightly higher in females. Also females having overcrowding in their houses are more prone to pneumonia (LRTI) than males.

Keywords: Acute respiratory infections, Malnutrition, Male, Female, Socio-demographic, Environmental

INTRODUCTION

Acute Respiratory Infections and malnutrition are one of the most commonly seen diseases in the pediatric age group. Acute Respiratory Infections in pediatric age group is a major concern in developing countries like India.[1,2] In the most recent estimate of the ARI associated mortality in India, pneumonia was held to responsible for 369,000 deaths among 'under 5' age group children making it the single most fatal disease in this age group.[3] Prevalence of malnutrition/underweight children in India is among the highest in the world, and is nearly double that of Sub-Saharan Africa. Child health is a matter of concern in developing countries like India. Predominantly, Pneumonia and Bronchiolitis comprising the Lower Respiratory Tract Infections along with Upper Respiratory Tract Infections have some severe implications on the health of pediatric population when they occur recurrently. Pneumonias can prove fatal at times especially in the areas where immediate health care facilities remain unavailable due to absence of tertiary health care centers. Malnutrition is another serious health related hazard, which can have devastating effects on the overall growth and development of the child and also is quite rampant in our society. ARI and Malnutrition affects the physical growth, morbidity, mortality, cognitive development, reproduction and physical work capacity and it consequently impacts on human performance, health and survival. By studying and assessing the relation between socio-demographic and environmental factors with acute respiratory infections and malnutrition we can certainly establish a certain relation between them and can therefore formulate a policy, which can reduce the disease burden significantly in these patients.

The aim and objectives of the study was to study the gender distribution and clinical profile of hospital based children with acute respiratory infections and malnutrition, to study some epidemiological factors responsible for acute respiratory infections and malnutrition in male and female children and to suggest recommendations based on study findings.

METHODS

This is a hospital based cross sectional study conducted at a tertiary care center, which is IGGMCH (Indira Gandhi Government Medical College and Hospital), Nagpur from 1st July 2014 to 31st August 2015 with total 100 children [admitted to Pediatric wards, Pediatric intensive care unit (PICU) as well as children visiting Pediatric OPD] fulfilling the following criteria were interviewed.

Inclusion criteria

- Children up to the age of 12 years.
- Children suffering from acute respiratory infections (ARI) including upper and lower respiratory tract infection.
- Malnourished children.

Exclusion criteria

- Children suffering from Pulmonary Tuberculosis (TB) or Extra Pulmonary Tuberculosis (ETB).
- Serious infections of lung, liver, heart, kidney and other organs.

Data collection

The structured questionnaire was designed to seek the information related to detailed socio-demographic profile like age, gender, residence, education of child as well as parents, religion, socio-economic status, attendance to day care centers/Anganwadi, type of diet and breast feeding/weaning practices. Environment of the residence of each study subject, particularly cooking environment of the kitchen with regards to size of the kitchen, type of construction, type of floor, roof, walls, number of rooms, windows, site where kitchen was located, presence or absence of chimney/smoke vent in the kitchen and presence or absence of soot deposits in kitchen was noted. Also noted were other characteristics like adequacy of kitchen ventilation, overcrowding, time spent (hours) in household cooking per day and number of years of cooking experience. Exposure index (EI) was calculated by multiplying the number of hours spent in a day on cooking and the number of years of cooking experience. Details of ETS exposure were obtained using a structured questionnaire. The study subjects were also inquired regarding the number of smokers in family, type of tobacco product smoked and approximate number of cigarettes/bidis smoked per day and years of passive exposure to tobacco smoke. Overall exposure to ETS was estimated by multiplying number of cigarettes/bidis smoked daily in the household and years of exposure. Socio-economic status (SES) was estimated according to a modified Kuppuswamy's scale for children belonging to urban areas and Prasad scale for rural areas.

In addition, anthropometric measurements like length/ height, weight, head circumference, chest circumference, mid arm circumference (MAC) were estimated by means of measuring tape. On similar lines weight for age was determined for all subjects by observed weight in kilograms divided by expected weight in kilograms for the same age were calculated.

Along with this general examination including the respiratory rate, heart rate, blood pressure, clubbing, cyanosis, pallor, icterus, lymphadenopathy, edema feet, jugular venous pressure (JVP) was also seen. Systemic examination was also performed with special emphasis on respiratory system in patients of ARI along with treatment history. The entire data was collected with the aid of preformed structured questionnaire.

Data management and statistical analysis

The collected data was analysed statistically by using Percentages, chi square test trend, student t test using 'Open Epi Info statistical package programme version 2.3 year 2009'. Statistical significance was assessed at a type I error rate of 0.05.

RESULTS

It was observed that 67.8% of male children and 80.49% of female children belonged to less than or equal to 5 years age group. 32.20% male and 19.51% females were in the age group of more than 5 years. 74.58% of the male study subjects belonged to urban regions whereas 82.93% females belonged to urban region.

Similarly, 25.42% of the male study subjects belonged to rural regions and 17.07% of females belonged to rural regions. However on applying chi-square test, difference between them was not found to be statistically significant as (P=0.16).

Table 1: Socio-demographic correlate of children.

Socio-demographic correlate	Male (N=59)	Female (N=41)	Statistical test (χ^2 test, P value)
Age group			
Less than or equal to 5 years	40 (67.80)	33 (80.49)	
More than 5 years	19 (32.20)	8 (19.51)	0.07
Residence			
Urban	44 (74.58)	34 (82.93)	
Rural	15 (25.42)	7 (17.07)	0.16
Education of mother			
Illiterate			
Primary	20 (33.89)	9 (21.95)	
Middle school	8 (13.55)	9 (21.95)	
High School	12 (20.33)	9 (21.95)	
Post High School	13 (22.03)	7 (17.07)	0.54
Graduate	3 (0.05)	5 (12.20)	df=5
Post-Graduate/	3 (0.05)	2 (0.04)	
Professional	0	0	
Education of father			
Illiterate	13 (22.03)	8 (19.52)	
Primary	7 (11.86)	2 (4.87)	
Middle school	11 (18.64)	11 (26.82)	
High School	19 (32.20)	7 (17.07)	0.16
Post High School	4 (6.77)	8 (19.52)	df=5
Graduate	5 (8.47)	5 (12.20)	
PG/Professional	0	0	
Occupation of father			
Unemployed	0	0	
Unskilled	13 (22.03)	11 (26.82)	
Semi-skilled	2 (3.38)	1 (2.43)	
Skilled	23 (38.98)	13 (31.70)	0.97
Clerk/Business	15 (25.42)	12 (29.26)	df=5
Semi-professional	2 (3.38)	1 (2.43)	
Professional	4 (6.77)	3 (7.32)	
Socio-economic status			
High (Grade I, II) (Upper, Upper middle)	3 (5.08)	1 (2.43)	
Low (Grade III, IV, V) (Lower middle, Upper lower, Lower)	56 (94.92)	40 (97.57)	0.25 df=1
ETS			
Present	35 (59.32)	24 (58.54)	
Absent	24 (40.68)	17 (41.46)	0.46

Figures in parentheses indicate percentage

Table 2: Distribution of study subjects according to respiratory morbidities.

Respiratory morbidity	Male (N=59)	Female (N=41)	Statistical test
URTI	18 (30.50)	13 (31.71)	0.44
LRTI	41 (69.50)	28 (68.29)	
H/o PTB, AKT	4 (6.78)	5 (12.20)	0.27

Figures in parentheses indicate percentage

Table 3: Distribution of children according to malnutrition.

Classification	Male (N=59)	Female (N=41)	Statistical test χ^2 df 1 P value
Under 5 (WHO)	(N= 40)	(N= 33)	
SAM	17 (42.5)	11 (33.33)	0.21
MAM	5 (12.5)	8 (24.24)	0.09
NO malnutrition	18 (45)	14 (42.42)	-
Above 5 (IAP)	(N=19)	(N=8)	
Normal	8 (42.10)	4 (50)	
Grade I	2 (10.52)	2 (25)	
Grade II	3 (15.78)	1 (12.5)	0.35
Grade III	3 (15.78)	0	
Grade IV	3 (15.78)	1 (12.5)	

Figures in parentheses indicate percentage

Table 4: Distribution of environmental factors among study subjects.

Environmental factors	Male (n=59)	Female (n=41)	Statistical test χ^2 df 1 P value
Over crowding			
Present	32(54.24)	19(46.34)	0.21
Absent	27(45.76)	22(53.66)	
Ventilation			
Adequate	25(42.37)	19(46.34)	0.34
Inadequate	34(57.63)	22(53.66)	
Cross ventilation			
Present	27(45.76)	17(41.46)	0.33
Absent	32(54.24)	24(58.54)	
Cooking fuel			
Chulla	14(23.72)	9(21.95)	
LPG	28(47.46)	20(48.78)	
Kerosene stove	6(10.17)	3(7.31)	0.94
Chulla + LPG	7(11.86)	5(12.20)	
Chulla + Kerosene stove	3(5.08)	2(4.88)	
LPG + Kerosene stove	1(1.7)	2(4.88)	

Figures in parentheses indicate percentage

33.89% of the male patient's mothers were illiterate as compared to 21.95% of the female patient's mothers. Similarly 66.11% of the male patient's mothers were educated (considering education from primary to graduation) and 78.05% of the female patient's mothers were educated (considering education from primary to graduation).

Occupations of fathers of male and female children/study subjects were classified as unemployed, unskilled, semi-skilled, skilled, clerk/business, semi-professional and professional. 6.77% fathers of male children were professionals as compared to 7.32% of fathers of female study subjects. Similarly 22.03% of male study subject fathers were unskilled as compared to 26.82% of female study subject fathers. 38.98% of male study subject fathers were skilled as compared to 31.70% of female study subject fathers. However, on calculating the difference between male and female study subjects by chi-square test the difference was statistically insignificant (P=0.97).

Table 5: Distribution of (mean±sd) anthropometric measurements among study subjects.

Anthropometric measurements	Mean ± SD		t test, P value
	Male (n=59)	**Female (n=41)**	
Mean Height (observed)	87.29 ± 22.50	87.29 ± 21.05	**0.76**
Mean Weight (observed)	11.05 ± 5.70	11.05 ± 5.81	**0.89**
Mean Height/Age	90.80 ± 13.29	90.80 ± 6.02	**0.99**
Mean Weight/Age	71.56 ± 16.65	71.56 ± 15.01	**0.99**

Figures in parentheses indicate percentage

Table 6: Relationship between pneumonia and environmental factors in male and female study subjects.

Environmental factors	Male (N=59)	Females (N=41)	Statistical test χ^2 df 1 P value
Overcrowding present	32 (54.23)	29 (70.73)	0.04
Inadequate ventilation	34 (57.62)	22 (53.65)	0.34
Absent cross ventilation	32 (54.24)	24 (58.54)	0.33
Chulla present	24 (40.68)	16 (39.02)	0.43
ETS present	35 (59.32)	24 (58.54)	0.46

On considering the socioeconomic status of the male patients almost 5.08% of them belonged to high strata (upper, upper middle, Grade I-II) and 94.92% belonged to low strata (lower middle, upper lower, lower, Grade III, IV, V). In case of female patients 2.43% belonged to higher strata and 97.57% belonged to lower strata. Exposure to tobacco smoke (ETS) history was also taken among study subjects and in 59.32% of the male patients it was present and absent in 40.68%. Similarly in case of female patients ETS was present in 58.54% of the patients and absent in 41.46%. On calculating the

difference by chi-square test, the difference was not statistically significant as (P=0.46). Upper respiratory tract infections (URTI) and Lower respiratory tract infections (LRTI) are basically the type of respiratory morbidities we have considered. 30.50% of the male patients had URTI whereas 31.71% of the female patients had URTI. Similarly 69.50% of the male patients were suffering from LRTI as compared to that of 12.20% in females. However on calculating the difference between the two by chi-square test, it was found that the difference was statistically insignificant as (P=0.44).

For children whose age was less than or equal to 5 years were classified on the basis of WHO classification into SAM (Severe Acute Malnutrition), MAM (Moderate Acute Malnutrition), or NM (No Malnutrition). In children Under 5 years' old category, around 42.50% males were suffering from SAM as compared to 33.33% female study subjects. Similarly 24.24% female study subjects were suffering from MAM as compared to 12.5% males. 45% of the male study subjects and 42% of the female study subjects were under the category of No Malnutrition (NM). However the difference was found to be statistically insignificant. In children Above 5 category 42% male children were Normal as compared to 50% female study subjects. 25% of females were also found to be suffering Grade I malnutrition as compared to 10.52% of male children. In male study subjects approximately 15.78% was each suffering from Grade II, III, IV malnutrition. However the difference was found to be statistically insignificant. The incidence of presence or absence of overcrowding, ventilation and cross ventilation were more or less similar in male and female study subjects and the differences between them were found to be statistically insignificant.

Assessment of Environmental factors was done amongst male and female study subjects and similarly chulla was being used in the households of 23.72% of male study subjects as compared to 21.95% of female study subjects. LPG was being used in the households of 47.46% of male study subjects as compared to 48.78% female study subjects. The difference was again found to be statistically insignificant. Anthropometric measurements (Mean ± SD) among study subjects. Mean Height, Mean Weight, Mean Height/Age, Mean Weight/Age are the parameters, which were assessed. All the parameters had minimal difference between male and female study subjects and the difference was found to be statistically insignificant. Similarly relationship of the environmental factors in male and female study subjects who were diagnosed with pneumonia (LRTI) was also assessed. Overcrowding was present in 54.23% of the male children as compared to 70.73% of the female children. The difference between the two was calculated by chi-square test and P=0.04, which is statistically significant. Similarly inadequate ventilation was again found to be present in 57.62% of the male study subjects and 53.65% of female study subjects. Difference between the two was calculated by chi-square test and P=0.34, which is statistically insignificant. Cross ventilation was absent in 54.24% of the males and 58.54% of females. However on chi-square test difference was found to be clinically insignificant as (P=0.33). Chulla was present in the households of 40.68% males and 39.02% of females. On chi square test (P=0.43), which is statistically insignificant. Environmental Tobacco smoke exposure was present in 59.32% of males and 58.64% of females. On calculating the difference between the two by chi-square test P=0.46 and is statistically insignificant.

DISCUSSION

Globally around 4.2 million ALRI deaths are estimated to occur among all age groups; of these 1.8 million are estimated to occur among children 1-59 months old.[4] Similarly each year approximately 2.3 million deaths among 6-60 months aged children in developing countries are associated with malnutrition, which is about 41% of total deaths in that age group.[5] Recent estimates suggest that 3.5% of global burden of disease is caused by ARI. In developing countries, on an average every child has five episodes of ARI/year accounting for 30% to 50% of total pediatric outpatient visits and 20% to 30% pediatric admissions.[6]

A rural study from Haryana by Broor et al, reported 2387, 536, 43 episodes of acute upper respiratory infections, acute lower respiratory infections and severe lower respiratory infections respectively per 1000 child years.[7] Similarly a study conducted by Gladstone et al in 2008 at an urban slum of Vellore district showed 7.4 episodes of ARI per child year.[8] Another study conducted by Gladstone et al in urban slums around Vellore suggested that ARI contributed to 58.2% of childhood morbidities.[9] Study conducted by Sarkar et al in semi-urban slums surrounding the Vellore district showed that ARI contributed to 60.2% of self-reported morbidities among children. It also showed an occurrence of 7.5 episodes of ARI/child year and another interesting finding was that 98% of the ARIs were actually URTIs.[10]

Several small scale community based studies over the years have reported that poor socio-economic factors; low level of literacy, suboptimal breast feeding malnutrition, unsatisfactory level of immunization coverage, cooking fuel used other than liquefied petroleum gas as risk factors contributing to increased burden of ARI among children.[11-13] As per a study by Krishnan et al incidence of ARI in 0-10 year of age was found to be 5.9 per child-year with minimal gender difference. The study comprised of slightly more boys (52.4%) than girls (47.6%). Together these children contributed to a total sample size of 137,836 child weeks of surveillance. There were no major differences in surveillance coverage.[14]

We evaluated the clinico-epidemiological profile of acute respiratory infections (ARI) and malnutrition in pediatric population of Indira Gandhi government medical college

(IGGMC), Nagpur. Present study showed high prevalence of malnutrition (70%) among children aged 0 to 15 years with LRTI (75%) and URTI (74.92%). The factors responsible for malnutrition evident in our study were aged less than 5 years (56.16%), illiterate mothers (62.07%), illiterate fathers (52.38%) and low socioeconomic status (56.25%). Dwarte DM et al found the ARI prevalence in children under five years to be 25.6%. From the total number of 491 children, 76.4% (n=375) had UAI and 23.6% (n=116) ALRI. The most frequent respiratory symptoms were nasal discharge (82.1%) and cough (80.4%). Around 6.1% of the total numbers of the cases were due to pneumonia (77.7%) of the cases involving hospitalization. There were no associations of ARI with children s nutritional status, family income or passive smoking. There was statistical association found between maternal educational status and ALRI (X (2) = 16.57).[15]

Considering study subjects on the basis of Z scores of weight on anthropometric measurements; 40 % of the study subjects belonged to the Z score range of <-3 SD (severely malnourished) and 22% of the study subjects were in the range of (-2 to -3 SD) i.e. moderately malnourished. Taking into account study subjects on the basis of Z scores of height on anthropometric measurements, around 28 % of the study subjects were in the Z score range of <-3 SD (severely malnourished) and 27% of the study subjects were in the range of (-2 to -3 SD) i.e. moderately malnourished. In a study conducted by Lodhi RS according to height for age Z-score, out of 100 children studied, 80 were normal while 17 were stunted and 3 were severely stunted. According to weight (see text) Z-score, 79 children were normal, 11 were underweight and 10 were severely underweight. According to weight for height Z-score, 83 children were normal while 13 were wasted and 4 were severely wasted.[16]

Socio demographic correlates (like age, residence, education of mother/father, occupation of father, socioeconomic status, ETS) were not found to be statistically significant between male and female children. Study carried out by Macedo SE et al also found the same risk factors associated with the outcome i.e. being male, children under six months of age, household crowding, maternal education, family income, inadequate housing conditions, lack of breastfeeding, maternal smoking, use of pacifiers, and a previous history of hospitalization and respiratory symptoms.[17]

The prevalence of URTI was found to be slightly more among female children (31.71%) as compared to male children (30.50%), whereas the prevalence of LRTI was found to be slightly more among male children (69.50%) as compared to female children (68.50%). El-Gilany et al noted the prevalence of ARI to be significantly higher in urban areas, among children, among males and during the colder seasons of the year.[18]

Moreover the prevalence of SAM was observed to be high among male children (42.5%) as compared to female children (33.33%). Contrary to SAM, the prevalence of MAM was found to be more among female children (24.24%) as compared to male children (12.5%). Mean anthropometric measurements like mean height, mean weight, mean height for age, mean weight for age for male and female children residing in urban and rural areas are not found to be statistically significant ($p<0.05$). More proportion of mothers of rural children were found to be illiterate (54.54%) as compared to urban children (21.80%) ($p<0.01$).

The prevalence of URTI was found to be more among rural children (36.36%) as compared to urban children (29.48%), whereas the prevalence of LRTI was found to be more among urban children (70.52%) as compared to rural children (63.64%). Moreover the prevalence of SAM was observed to be high among urban children (38.59.5%) as compared to rural children (37.5%). Contrary to SAM, the prevalence of MAM was found to be more among rural children (18.75%) as compared to urban children (17.54%). Birdi TJ et al found Malnutrition to be highly prevalent amongst all age groups with 54% children aged 1-5 years and 43% adults aged ≥20 years being severe to moderately underweight.[19]

As far as environmental factors are concerned, more number of rural children had inadequate ventilation (72.73%) and absent cross ventilation (77.27%) in their homes when compared with urban children ($p<0.05$). Acharya D et al reported 8.2% pneumonia and only 0.51% severe pneumonia.[20] Incidence of ARI was almost same in male and female children. There was no significant difference in incidence among various age groups. But the incidence of pneumonia was significantly higher among infants ($p<0.00002$). Children of poor housing with smoke producing conditions suffered more frequently ($P<002$).

Pneumonia was found to be highly prevalent in male children belonging to rural areas living in overcrowded dwellings, inadequate ventilation, absence of cross ventilation, presence of chulha and ETS. Ujunwa F et al, observed that children less than 20 months accounted for 60.9% (84/138 cases) of pneumonia, 86.7% (26/30 cases) of bronchiolitis, and 64.5% (173/268 cases) of acute upper respiratory tract infections. Pneumonia was noted in about 75.7% (56/74) of inadequately nourished children compared to 22.6% (82/362) in adequately nourished children.[21] Other risk factors identified in the study included inadequate breast feeding, poor immunization statues, attendance to day-care centers, large family size, poor parental educational statues, parental smoking, living in the urban area and use of biofuels. Million deaths study has also reported increasing prevalence ratio (PR=1.54 among males, PR= 1.94 among females) of respiratory infections due to use of solid fuel.[22]

A nationwide study conducted by National Family Health Survey-3 (NFHS-3) showed a 40.4% prevalence of malnutrition in children less than 3 years of age in the country. It also showed a prevalence of 1.5% overweight children in the same age group.[23] A study conducted by Kapur et al in urban slum of Delhi in children between the age groups of 9-36 months showed a prevalence of 74% stunting, 75% underweight, 19% wasting (24). In another study conducted by Rao et al, in Jabalpur district of Madhya Pradesh, which also included tribal villages in the nearby region showed 51.6% children to be stunted, 61.6% to be underweight and 32.9% to be wasted according to the WHO criteria.[25] In another study conducted by Bisai S et al in West Bengal's Mednipur district in the children of 1-14 age group it was found that 26.1% children are stunted, 33.9% children are underweight and 19.4% are wasted.[26] In a study conducted by Espie et al in Darbhanga district of North Bihar in under 5 children showed some striking results. Apparently the prevalence of Global Acute Malnutrition (GAM) or Severe Acute Malnutrition (SAM) was 15.4% and 19.4% respectively according to NCHS child growth references and WHO references. This study also suggested that children in Darbhanga district were in a borderline food crisis with few food resources.[27] A study conducted in Ernakulam district of Kerala among 5-16 years age group highlighted that childhood obesity showed an increasing trend.[28]

Factors associated with socioeconomic inequality such as poverty, illiteracy, lack of awareness regarding the quality of food items, large family and poor sanitary environment are associated with malnutrition.[29] The malnutrition is found to be 2.7 times higher among families with lower household wealth index.[30]

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. Lancet. 2012;379:2151-61.
2. Mulholland K. Childhood pneumonia mortality–a permanent global emergency. Lancet. 2007;370:285-9.
3. Million Death Study Collaborators; Bassani DG, Kumar R, Awasthi S, Morris SK, Paul VK, et al. Causes of neonatal and child mortality in India: a nationally representative mortality survey. Lancet. 2010; 376:1853-60.
4. World Health Organization: The global burden of disease: 2004 update. Geneva: World Health Organization 2008 http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf, Accessed 8 November 2009.
5. Schroeder DG, Brown KH. Nutritional status as a predictor of child survival: Summarizing the association and quantifying its global impact. Bull World Health Organ. 1994;72:569-79.
6. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. Bull World Health Organ. 2008;86:408-16.
7. Broor S, Parveen S, Bharaj P, Prasad VS, Srinivasulu KN, Sumanth KM, et al. A prospective three-year cohort study of the epidemiology and virology of acute respiratory infections of children in rural India. PLoS One. 2007;2:e491.
8. Gladstone BP, Das AR, Rehman AM, Jaffar S, Estes MK, Muliyil J, et al. Burden of illness in the fi rst 3 years of life in an Indian slum. J Trop Pediatr. 2010;56:221-6.
9. Gladstone BP, Muliyil JP, Jaff ar S, Wheeler JG, Le Fevre A, Iturriza-Gomara M, et al. Infant morbidity in an Indian slum birth cohort. Arch Dis Child. 2008;93:479-84.
10. Sarkar R, Sivarathinaswamy P, Thangaraj B, Sindhu KN, Ajjampur SS, Muliyil J, et al. Burden of childhood diseases and malnutrition in a semi-urban slum in southern India. BMC Public Health. 2013;13:87.
11. Acharya D, Prasanna KS, Nair S, Rao RS. Acute respiratory infections in children: A community based longitudinal study in south India. Indian J Public Health. 2003;47:7-13.
12. Savitha MR, Nandeeshwara SB, Kumar MJ, ul-Haque F, Raju CK. Modifiable risk factors for acute lower respiratory tract infections. Indian J Pediatr. 2007;74:477-82.
13. Broor S, Pandey RM, Ghosh M, Maitreyi RS, Lodha R, Singhal T, et al. Risk factors for severe acute lower respiratory tract infection underfive children. Indian Pediatr. 2001;38:1361-9.
14. Krishnan A, Amarchand R, Gupta V, Lafond KE, Suliankatchi RA, Saha S, et al. Epidemiology of acute respiratory infections in children - preliminary results of a cohort in a rural north Indian community. BMC Infect Dis. 2015;15:462.
15. Duarte DM, Botelho C. Clinical profile in children under five year old with acute respiratory tract Infections. J Pediatr (Rio J). 2000;76(3):207-12.
16. Lodhi HS, Mahmood-ur-Rehman, Lodhi FS, Wazir S, Taimoor AR, Jadoon H. Assessment of nutritional status of 1-5 year old children in an urban union council of Abbottabad. J Ayub Med Coll Abbottabad. 2010;22(3):124-7.
17. Macedo SE, Menezes AM, Albernaz E, Post P, Knorst M. Risk factors for acute respiratory disease hospitalization in children under one year of age. Rev Saude Publica. 2007;41(3):351-8.
18. El-Gilany AH. Acute respiratory infections in primary health care centres in northern Saudi Arabia. East Mediterr Health J. 2000;6(5-6):955-60.

19. Birdi TJ, Joshi S, Kotian S, Shah S. Possible causes of malnutrition in Melghat, a tribal region of Maharashtra, India. Glob J Health Sci. 2014;6(5):164-73.
20. Acharya D, Prasanna KS, Nair S, Rao RS. Acute respiratory infections in children: a community based longitudinal study in south India. Indian J Public Health. 2003;47(1):7-13.
21. Ujunwa F, Ezeonu C. Risk Factors for Acute Respiratory Tract Infections in Under-five Children in Enugu Southeast Nigeria. Ann Med Health Sci Res. 2014;4(1):95-9.
22. Child mortality from solid-fuel use in India: A nationally-representative case-control study-Child-mortality-from-solid-fuel-use-in-India-2010. pdf. Available from: htt p://cghr.org/wordpress/wp-content/uploads/Child-mortality-from-solid-fuel-use-in-India-2010.pdf. Last accessed on 2013 Mar 11.
23. National Family Health Survey-3. Mumbai: International Institute of Population Science; 2005-06.
24. Kapur D, Sharma S, Agarwal KN. Dietary intake and growth pattern of children 9-36 months of age in an urban slum in Delhi. Indian Pediatr. 2005;42:351-6.
25. Rao VG, Yadav R, Dolla CK, Kumar S, Bhondeley MK, Ukey M. Undernutrition & childhood morbidities among tribal preschool children. Indian J Med Res. 2005;122:43-7.
26. Bisai S, Bose K, Ghosh A. Nutritional status of Lodha children in a village of Paschim Medinipur district, West Bengal. Indian J Public Health. 2008;52:203-6.
27. Espié E, Pujol CR, Masferrer M, Saint-Sauveur JF, Urrutia PP, Grais RF. Acute malnutrition and under-5 mortality, northeastern part of India. J Trop Pediatr. 2011;57:389-91.
28. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: Time trends and relationship with hypertension. Natl Med J India. 2007;20:288-93.
29. Van de Poel E, Hosseinpoor AR, Speybroeck N, Van Ourti T, Vega J. Socioeconomic inequality in malnutrition in developing countries. Bull World Health Organ. 2008;86:282-91.
30. National Family Health Survey-3. Mumbai: International Institute of Population Science; 2005-06.
31. WHO, UNICEF. Global action plan for prevention and control of pneumonia (GAPP). Geneva; 2008. Available at http://www.unicef.org/media/files/GAPP3_web.pdf

Cite this article as: Jawade PG, Sukhsohale ND, Khamgaonkar MB, Jawade GG, Aklujkar SP, Dudhe RK, et al. A comparative clinico-epidemiological study of acute respiratory infections and malnutrition in male and female children of central India. Int J Contemp Pediatr 2016;3:993-1000.